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Pathology Newsletter
March 2023

Point-of-Care Testing (POCT) and Laboratory Analysis of Urine Samples

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Introduction

The use of the urine dipstick within a point of care setting, can provide a clinician with a lot of valuable information in the context the patient's health.

This coupled with laboratory analysis of urine (urinalysis), may facilitate early diagnosis and correct treatment or patients with a host of different conditions.

Most commonly used within the setting of urinary tract infections (UTI's), it can also be applied as screening for metabolic, hepatic, renal and haematological disease. Notably, UTI's account for as much as 1 - 3% of consultations by adult patients in general practice[1] and for up to 13,7% of antibiotic prescriptions[2], highlighting its importance as a community health issue.

In many instances, the first line evaluation of the patient would be through the POCT urine dipstick method. It holds the advantage of 99% specificity but 45% sensitivity for UTI if positive for urine leucocyte esterase and nitrites but cannot provide information as to the causative pathogen[3].

Urine dipstick tests are the most commonly used clinical test in the diagnosis of patients with urinary tract infection, as they are cheap and simple to operate. Because quantitative urine culture takes a long time, a urine dipstick test can be performed first and then confirmed by microscopy and urine culture. The combination of these 2 test methods can effectively improve the detection rate, reduce the false positive rate and most importantly allow for targeted treatment and reduce antibiotic misuse[4].

This article serves to highlight the essential points around POCT and laboratory urinalysis and how it should be applied in clinical practice. It also attempts to show the shortcomings of these tests and therefore areas where discrepancies in results may occur.

Conclusion

The combination of POCT and formal urinalysis serves a supplementary function in the evaluation of a patient's clinical condition.

Comprehending the shortcomings of each platform enables more prudent interpretation of results and ultimately the effective treatment of the patient.

References

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4. Xie R, Li X, Li G, Fu R. Diagnostic value of different urine tests for urinary tract infection: a systematic review and meta-analysis. Transl Androl Urol. 2022 Mar;11(3):325-335. doi: 10.21037/tau-22-65. PMID: 35402195; PMCID: PMC8984977.

Tests	Results	Testing method	Pre- and Analytical considerations
Microbiology			
Specimen Site	Urine sample, light yellow, turbid	Macroscopic, visual evaluation	
Urine Chemistry			
U-pH	5	Tetrabromophenol blue or tetrachlorophenol.	Delay in transport. Reagent overflow from protein patch.
Urine MCS			
U-Leucocytes	Trace	Labile neutrophils release leucocyte esterase. Enzymatic measure with colour correlating to concentration.	False positives (FP) with vaginal fluid contamination.
U-Nitrate	Negative	Certain classes of bacteria reduce nitrates to nitrites. Requires 104 to 105/mL organisms *and* time to convert = therefore useful only in first morning sample.	Discrepant POCT and Laboratory results possible with delay or certain bacteria. FN - low nitrate diet, urobilinogen.
U-Urobilinogen	Normal	Uses Ehrlich aldehyde or Redazo dye methods.	Labile and requires a fresh sample. Discrepant POCT and Laboratory results possible.
U-Protein	Negative	Tetrabromphenol blue typically used. More sensitive for albumin than other proteins.	False positives with alkaline or quartarnary amine contamination (disinfectants).
U-Blood / Hb	Trace	H2O2 chromogen method used. Will pick up 0,3mg Hb/mL (approx. 10 red blood cells).	Tests positive with haemoglobin and myoglobin.
U-Specific Gravity	1.020	Indirect polyelectrolyte indicator.	Not affected by glucose, protein or contrast media.
U-Ketones	Negative	Nitroprusside method. Most sensitive to aceto-acetic acid then acetone.	Does not react with 3-hydroxybutyrate.
U-Bilirubin	Negative	Diazo method. Bilirubin rapidly hydrolysed therefore fresh sample is essential.	Discrepant POCT and Laboratory testing may occur due to delay. FP - Rifampicin.
U-Glucose	Negative	H2O2 chromogen method. Sensitive to only glucose.	Not adequate in newborn screening as all reducing sugars need to be detected.
Urine Microscopy			
U-Leucocytes	8 / hpf	Neubauer counting chamber used. Counting 9 fields x1000 to quantify it per mL.	FN - delay may lead to cells lysis.
Red bloods cells	3 / hpf	Neubauer counting chamber used. Counting 9 fields x1000 to quantify it per mL.	FN - delay may lead to cells lysis.
Epithelial Cells	++	Neubauer counting chamber used. Semiquantitative reporting.	

Tests	Results	Testing method	Pre- and Analytical considerations
Casts			
Hyaline	Present	From protein in renal tubules.	
Granular	Absent	Degenerated cellular material.	
Cellular	Absent	Degenerated and intact cellular material.	
White Blood Cells	Absent	Indicate infection.	Pyelonephritis or glomerular disease.
Red Blood Cells	Absent	Due to severe glomerular injury.	Acute glomerulonephritis Lupus. Bacterial endocarditis and septicaemia.
Urine Crystals			
Amorphous Urates	Present	No pathological significance.	
Amorphous Phosphates	Absent	No pathological significance.	
Calcium Oxalate	Absent	Ethylene glycol poisoning and high oxalate intake in diet.	
Uric Acid	Absent	High serum uric acid or uric acid renal stones present.	
Triple Phosphate	Absent	Associated with certain diets.	
Trichomonas vaginalis	Absent	Infection.	
Schistosoma haematobium	Absent	Infestation.	
Urine Culture			
Culture Comment	See identification below	Full identification with sensitivity profile reported.	
Antimicrobial substances	Present	Suppression of growth of *Bacillus subtilis* indicate antibiotic presence.	

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